

FOOD OF THE FOREST RED-TAILED BLACK COCKATOO *CALYPTORHYNCHUS BANKSII NASO* IN SOUTH-WEST WESTERN AUSTRALIA

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ABSTRACT

The principal foods of the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* in south Western Australia are the seeds of Marri *Corymbia calophylla* and Jarrah *Eucalyptus marginata*. Of these, Marri is the most important especially during the breeding season in October-February. Other less important foods in northern forests include Snottygobble *Persoonia longifolia*, Common Sheoak *Allocasuarina fraseriana*, Blackbutt *Eucalyptus patens* and in southern forests, Albany Blackbutt *E. staeri* and Karri *E. diversicolor*. Although some Marri and Jarrah seed is available all year, the flowering and subsequent fruiting of both species varies between years on about a 4-6 year cycle. Preliminary results from this study suggest that variations in the extent of flowering and nutting may determine the numbers of birds which attempt to breed.

INTRODUCTION

The Red-tailed Black Cockatoo *Calyptorhynchus banksii* is widely distributed within Australia. Five subspecies are currently recognised three of which occur in Western Australia (Figure 1) namely: *C. b. macrorhynchus* occurring throughout the Kimberley; *C. b. samueli* found in the arid and semi-arid northern and north-eastern interior (i.e. Pilbara, Gascoyne, northern Wheatbelt and Goldfields); and *C. b. naso* inhabiting the south-western humid and sub-humid zones (mainly the tall eucalypt forests). Ford (1980) and Johnstone and Storr (1998).

The Kimberley subspecies *macrorhynchus* is generally common occurring in pairs and family parties and small flocks in forests and woodlands. Its range and status have not altered greatly in the Kimberley since European settlement. The mid-western subspecies *samueli* has greatly expanded its range south into the northern wheatbelt in the past 60 years. Whereas it was originally confined to northern watercourses including the Murchison, Irwin and Lockier Rivers, it is now most numerous in the northern and north-eastern wheatbelt especially the Eurardy, East Yuna, Three Springs / Perenjori,

Jibberding and Trayning / Mukinbudin districts, occurring in pairs, small flocks and occasionally large flocks up to 500. The introduced South African weed the Double-gee *Emex australis* has become a major food source for *samueli* in the wheatbelt. This together with the provision of watering points for livestock has enabled *samueli* to increase in numbers and spread south into what was previously unsuitable habitat.

Conversely the arboreal forest inhabiting subspecies *naso* has experienced a severe decline since European colonisation. Formerly it occurred north to Dandaragan (where there were once large stands of Marri);

west to near Gingin (casually), Guildford (resident in colonial times but now rare or absent), Mundijong, Coolup, Lake McLarty and Goodale Sanctuary (16 km SW of Pinjarra) (presumably visitors from adjacent Darling Scarp), Wokalup, Big Brook (23 km west of Nannup), formerly to Vasse River, and Margaret River; and east to Mt Helena (formerly to Toodyay), Christmas Tree Well, North Bannister (formerly to Wandering), Mt Saddleback, formerly to the Kojonup district (where now only casual), Rocky Gully and upper King River (Figure 2). This forest cockatoo was formerly common throughout this historic range but is now rare to uncommon and

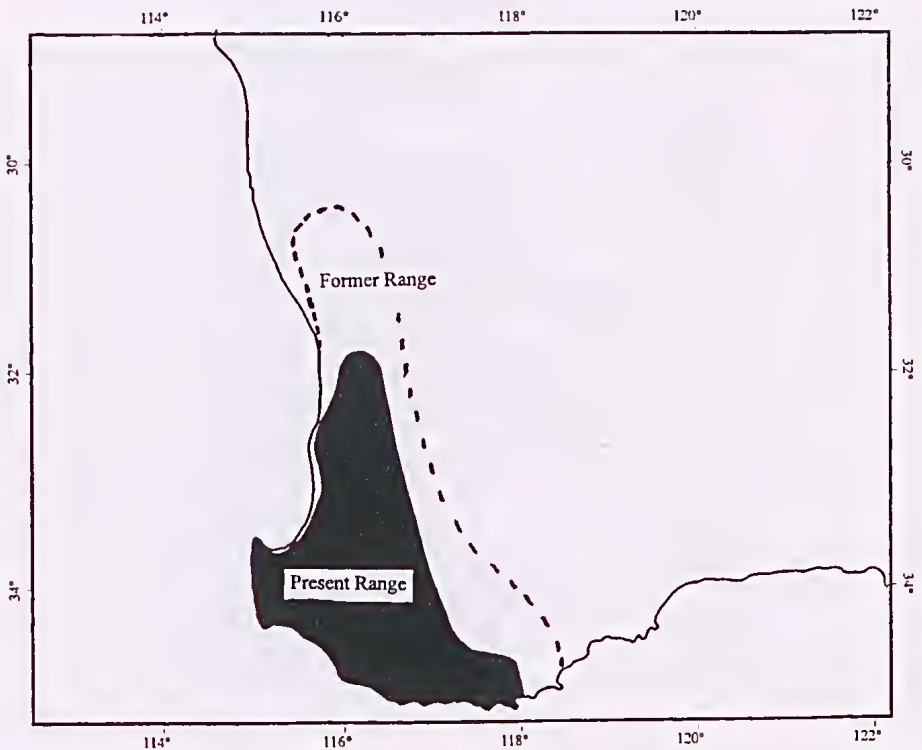


Figure 2. Distribution of *C. b. naso* in south-western Australia (showing present and former ranges).

Table 1. Monthly records (1996 to early 1999) with number of feeding observations (obs) and total number of birds recorded feeding on each food.

	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total		
	Obs.	No	Obs.	No	Obs.	No	Obs.	No	Obs.	No	Obs.	No	Obs.	No	Obs.	No	Obs.	No	Obs.	No	Obs.	No	Obs.	No	Obs.	No	
Marrri	15	178	11	124	6	52	7	77	3	10	5	42	12	119	6	38	4	59	7	28	6	120	14	113	96	960	
Jarrahdale	5	66	7	54	5	63	6	65	8	134	18	75	6	60	3	11	6	53	4	13	8	35	11	83	87	712	
Blackbutt	-	-	-	-	-	-	-	-	-	-	6	14	4	18	-	-	-	-	1	10	-	-	-	2	39	13	81
Allocasuarina	3	31	2	6	-	-	-	-	1	8	-	-	-	-	-	-	-	-	-	-	1	1	-	-	7	46	
Snottygobble (<i>Peroornia</i>)	-	-	-	-	-	-	2	7	-	-	8	15	2	9	-	-	-	-	-	-	-	-	-	-	-	12	31
Spotted Gum	-	-	-	-	2	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	36
<i>Banksia grandis</i>	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
Cape Lilac	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Melia azedarach</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	9	-	-	-	-	-	-	-	-	-	1	9

patchily distributed within its current range that has become markedly reduced through clearing for agriculture. It occurs mainly in pairs or small family groups (3-5) and occasionally large flocks up to 200 have been recorded.

It is perhaps noteworthy that although this large cockatoo is one of the most conspicuous birds in the southern forests its fundamental biology is still poorly understood. Most of the information concerning the diet is anecdotal Storr (1991), Abbott (1998), Johnstone and Storr (1998). Since 1996 we have been studying the distribution, status, conservation and breeding biology of *naso* in south-western forests. The aim of this paper is to identify its main foods and feeding techniques.

MATERIALS AND METHODS

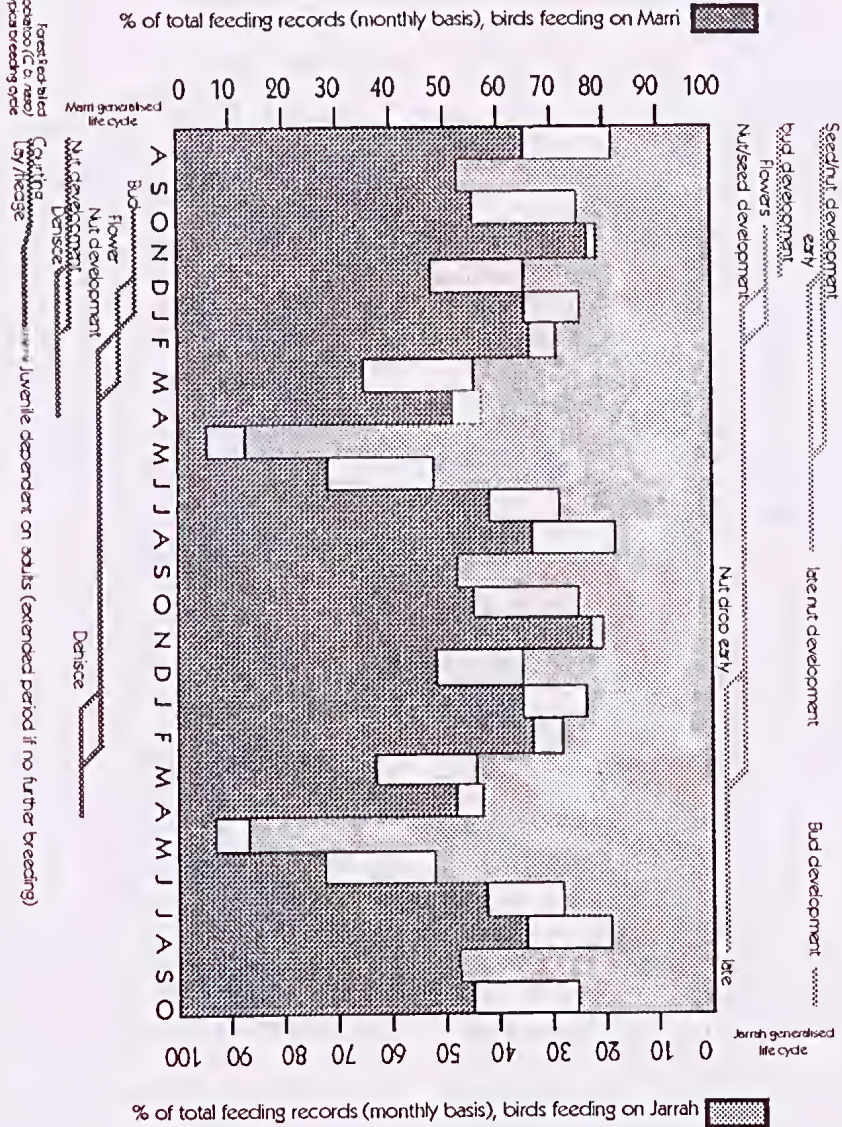
The cockatoos were studied at two main sites namely Bungendore Park - (including Wungong Brook) and Jarrahdale (including the Serpentine area). Visits were also made to other areas in the south-west including Collie, Albany, Denmark, Manjimup, Nannup and Margaret River to gather information on distribution, status, diet and breeding etc. The vegetation at the two main study sites at Bungendore Park and Jarrahdale is similar being predominantly Jarrah *Eucalyptus marginata* and Marri *Corymbia callophylla* with an understorey of Bull Banksia *Banksia grandis*, Snottygobble *Peroornia longifolia*, Allocasuarina *fraseriana* and *Dryandra* spp. Both sites also contain scattered stands of Blackbutt *Eucalyptus patens* and Wandoo *Eucalyptus wandoo*.

Fieldwork was conducted mostly on a weekly basis commencing in 1996 and continuing to early 1999. Flocks were located in the study sites usually in late afternoon or early morning and, once

located, we recorded the locality, time, number of birds and flock composition, habitat and behaviour including feeding behaviour. The estimated total

population in the Bungendore area is 70 birds and at Jarrahdale 100 birds. A total of 219 feeding observations were made in the main study sites (each

Table 2.
Forest Red-tailed Black Cockatoo (*C. b. naso*) Observations of food taken compared with
1. Marri Cycle. 2. Jarrah Cycle. 3. Breeding Cycle



observation ranging from several birds to the majority of the flock) (see Table 1). Food trees were noted, food samples including discarded nuts were collected and in some cases photographed.

RESULTS

FOOD AND FOOD AVAILABILITY

The principal food in both study sites was Marri and Jarrah (see Table 1) comprising almost 90% of the diet. We made 96 observations with a total of 960 birds feeding on Marri and 87 observations with a total of 712 birds feeding on Jarrah. Other less important foods include *Eucalyptus patens*, *Allocasuarina* and *Persoonia*. There were two observations of two birds feeding on dead *Banksia grandis*, two observations with a total of 36 birds feeding on the seeds of the introduced Spotted Gum *Eucalyptus maculata* and one observation of 9 birds feeding on the seeds of the introduced Cape Lilac *Melia azederach*. All food was taken from the tree canopy with the *Persoonia* and *Banksia* being small understorey trees.

Birds were recorded feeding on Marri throughout the year (see Tables 1 and 2), however there was a strong seasonal shift between March and June from Marri to Jarrah and other foods. Flower and subsequent fruit production of both Marri and Jarrah varies between years on about a four to five year cycle (see tree ecology below and Table 2). Preliminary results indicate that the extent of flowering and nut production may determine the numbers of nesting birds in the subsequent breeding season. Although some seed of Marri and Jarrah is available all year, the cockatoos are extremely selective with respect to which trees they feed in and there may be large differences in seed quality, nutrient value, seed size and seed fill.

They are methodical feeders returning each day to the same tree until the food supply is exhausted. It was frequently noted that adjacent trees of the same species were untouched throughout this feeding activity, even after the 'favoured' tree was depleted. It is also noteworthy that Marri provides both a much larger seed and a heavier seed crop when compared to Jarrah and other foods. For example Marri nuts contain approx 5–6 times the seed mass compared to Jarrah. The seed weight in Marri is 0.113g v Jarrah 0.020g; seed length Marri 12.9 mm v Jarrah 4.5 mm; and seed width in Marri 7.2 mm v 3.0 mm (Abbott 1984). Additionally fewer Marri nuts contain no seed than is the case of Jarrah. Thus the work effort needed to open a Marri nut is justified. The abundances of the various foods and feeding location, technique and timing highlighted the importance of Marri and the birds' knowledge of their territory.

FEEDING TECHNIQUES

The method of feeding on Marri and Jarrah was distinctive and of use in plotting the occurrence of these cockatoos after they have fed in an area. A bird either nips off a nut within range of one position or nips off a branch (up to 300 mm long and 9 mm thick) with several nuts and then, while still holding the branch breaks off individual nuts. In either case it extracts and husks the seed from the nut with its bill. Leaves and other small stems are often also nipped off to allow easier access to nuts. On finishing, the branch is dropped to the ground. The ground beneath the tree becomes littered with chewed nuts, leaves and small branches with up to 70% of the ground beneath the canopy covered in nuts and leaves. Attention is often drawn to a feeding

party by the sound of hard nuts being cracked open and the continual stream of debris falling to the ground. When feeding in the outer foliage birds often pulled thin branches together for more secure footing and one female was seen to wedge herself into a fork with a spray of nuts in windy conditions.

Marri

Usually a bird bites off a tough woody nut and transfers it to the foot, almost invariably the left foot (but some birds are right footed). Marri nuts are large, thick and woody with measurements ranging from 25–45mm long and 20 x 40mm in width and birds will feed on green to hardened ripe nuts. The Marri nuts are opened in a number of ways (Figures 3 and 4) with individuals using one of the following techniques:

1. Holding the nut by the pedicel and chopping their way into the bowl (or hypanthium) from the rim.
2. Holding the rim of the nut and chopping in at the base of the hypanthium.
3. Holding the nut at the rim or base and chopping in at the centre and rotating the nut in the foot anti-clockwise.

Depending on the individual skill of the bird it takes about one-two minutes (0.38 – 2.45 minutes) to extract and husk the seed from a Marri nut. One adult male extracted seeds from five green nuts in 3.12 minutes. On one occasion an adult female was also observed taking (grabbing) opened nuts from her mate feeding alongside, taking them from his foot just as the seeds were exposed.

Jarrah

Jarrah nuts are held firmly in the foot or

manoeuvred in the bill (Figure 5) and the seed capsule is split open by the bill and the seeds extracted and husked at a rate of 2–5 nuts per minute (see Figure 6). One adult extracted seeds from 30 nuts in 8.20 minutes. In some cases however only half the seeds from each nut are extracted.

Allocasuarina

Allocasuarina cones are held in the foot, split down the centre with the bill, then rotated with the foot in order to extract and husk the seeds. Times recorded to extract and husk the seeds from *Allocasuarina* cones range from 30–36 seconds. The seeds of *Allocasuarina* are retained in the mature cones for only 1–2 months (January-February) and after this time very little seed remains for the cockatoos to harvest.

The fruits of the Snottygobble (*Persoonia*) are split down the centre and the tiny seed extracted. Birds feed very slowly on Snottygobble at the rate of about 2 fruits per minute and not all fruits are eaten. Often adults spending time pruning the outer branches as well as feeding. Spotted gum nuts are handled the same way as jarrah nuts.

Cape Lilac fruits are sometimes held in the foot but mostly sliced in half and seeds extracted with just the bill and tongue.

DAILY ACTIVITY PATTERNS

In both study areas the flocks spend the night roosting in tall straight trunked isolated stands of Jarrah-Marri-Blackbutt growing in a road side verge, edge of a paddock or at the edge of a forest block. The birds usually leave their night roosts at sunrise (ca. 05:00 Western Standard time) split into smaller family groups and move into adjacent forest. Our study flocks (with

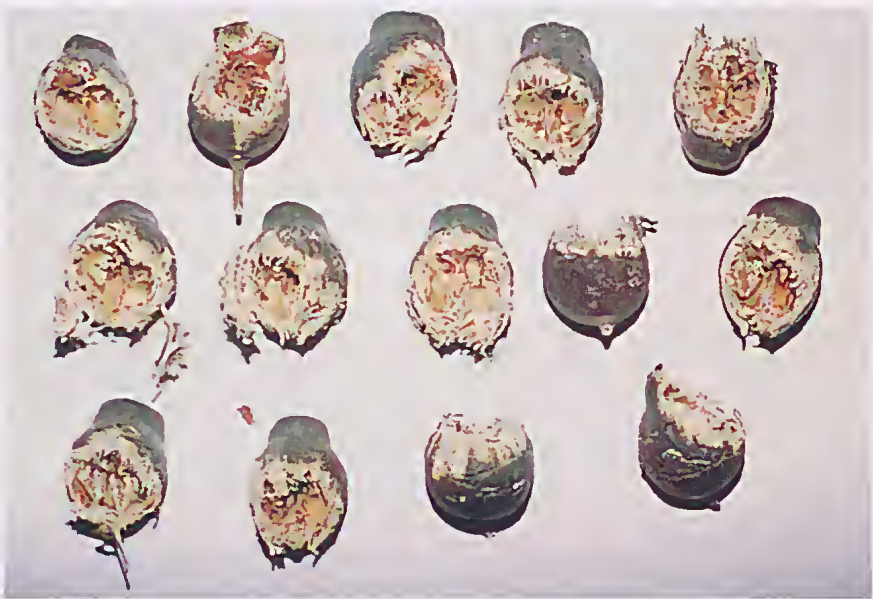


Figure 3. Discarded green Marri nuts from one tree showing range of opening methods.



Figure 4. Discarded Marri nuts eaten by naso showing both base (top row) and rim (bottom rows) opening methods.



Figure 5. Female *C. b. naso* with Jarrah nut in bill.

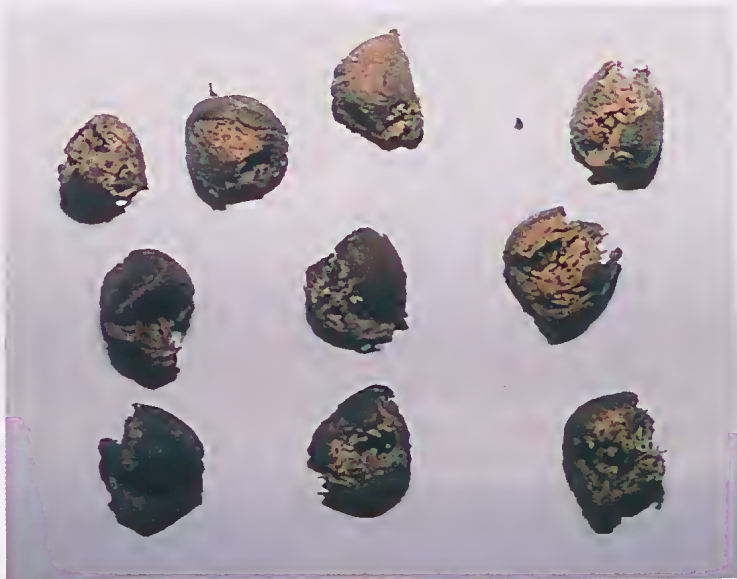


Figure 6. Discarded Jarrah nuts eaten by *naso*.

some banded birds) were usually located within 1–4 km of the roost. After a short period of preening and sometimes basking in morning sunlight they began feeding, usually in Marri or Jarrah trees.

Feeding continued for up to 10–12 hours sometimes with short breaks to move to another tree, preen or clean the bill. Bill cleaning involves wiping the bill on dead branches or chewing into dead wood especially Jarrah and Banksia. At around 16:00 to 17:00 hrs birds would stop feeding, begin bill cleaning and preening, become more vocal and move off in small groups to drink at water in tree hollows, creeks, puddles, dams and troughs. Overall they have a preference for drinking at tree hollows and appear quite uncomfortable on the ground. On dark, the birds would return to the roost area.

This behaviour was repeated each day unless there was a marked change in the weather especially with heavy rain and strong winds. Under these conditions birds foraged less and remained more subdued in their behaviour. When breeding the female leaves the nest hollow once or twice a day to be fed by the male (by pump regurgitation). It takes immatures over a year to develop the skills necessary to extract seeds from Marri nuts and during this period they are constantly attended by both parent birds. Young birds must also learn which trees produce nuts with seed in order not to waste effort on seedless nuts.

ECOLOGY OF MARRI AND JARRAH

The flowering and subsequent nutting of Marri and Jarrah varies significantly from one year to the next. Marri flowers heavily on a five year cycle (P. Mawson pers. comm.). Buds are initiated in August or September, mature by January when flowering commences, develop

into nuts in March–December and the seeds dehisce from mature nuts in January–February of the third year. Overall taking about 17 months between initiation of buds and the shedding of seeds. At the end of this cycle trees which produce a heavy flowering and crop of nuts, are in poor condition with reduced leaves in the canopy and few new leaves. The resources used in producing such large flowers and nuts are so great that the tree requires another three years to recover enough to repeat the process. In any one year only about 20–50 percent of the trees produce a large nut crop. It is also noteworthy that a small proportion of Marri trees produce only male flowers and seedless fruits (Carr et al. 1981).

In Jarrah, flowering occurs every 4–6 years (Abbott and Loneragan 1986). Buds are initiated in December–January each year and if conditions are favourable they are retained and develop further, flowering between September and December. These flowers develop into nuts during the next year and mature in September. Seed is shed three months later in December–March taking overall 24–27 months from bud initiation to shedding seed.

CONCLUSIONS

Habitat destruction has clearly caused the Forest Red-tailed Black Cockatoos marked decline in south-western Australia. The extensive clearing of the Jarrah-Marri and Wandoo forest and woodland, largely for agriculture, has led to a loss of over one third of its original range. Land clearing has slowed greatly in recent years. Cockatoos are however long-lived and it is not clear whether this factor is masking a continuing decline in their overall populations.

The birds are currently only patchily distributed throughout the south-western forests. Judging from this study the cockatoos are relatively sedentary and could be extremely vulnerable to habitat loss and fragmentation. The two limiting factors in the birds' survival are food and suitable nest hollows. At present it would appear that the food supply in both study sites is adequate, however quality as well as quantity may be crucial (especially in breeding season). In this context further study is required as to why some trees are extensively cropped whilst others apparently at a similar stage are ignored. The cockatoos are highly dependent for food (and nest hollows) on Marri and to a lesser extent on Jarrah (R. Johnstone, unpublished data). Observations of flock movements, diet changes and breeding times appears to be coincident with the heavy nutting cycle of the Marri so food may be a limiting factor in breeding times. Breeding was only recorded in both study sites in October-December of 1995 and 1997 when both areas had a heavy Marri nut crop. It is also noteworthy that even in these two breeding years only some 10% of the flock in both study areas attempted (or appeared capable) of breeding. Further research into the breeding biology of this subspecies is in progress.

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